



REVIEW

Evaluation of surgical procedures for sex reassignment: a systematic review

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Summary *Objectives:* To evaluate earlier reviews and literature concerning five individual surgical procedures for male-to-female (MTF) transsexism: clitoroplasty, labiaplasty, orchidectomy, penectomy and vaginoplasty. Further evaluations were made of eight surgical procedures for female-to-male (FTM) transsexism: hysterectomy, mastectomy, metoidoplasty, phalloplasty, salpingo-oophorectomy, scrotoplasty/placement of testicular prostheses, urethroplasty and vaginectomy.

Background: Increased prevalence and advances in surgical options available to patients requesting gender reassignment surgery have made this an important consideration for research. There remains a lack of systematic reviewing of the evidence, in particular, of the individual surgical options available.

Methods: Searches were undertaken in six electronic databases (Applied Social Sciences Index and Abstracts [ASSIA], Cochrane Library [Wiley Online], Embase [Ovid Online], Medline [Ovid Online], Medline in Process [Ovid Online], Psycinfo) providing coverage of the biomedical, grey literature and current research.

Results: Eighty-two published papers (38 MTF; 44 FTM) met the inclusion criteria identified across the 13 surgical procedures. For MTF transsexism there was no evidence satisfying the inclusion criteria concerning labiaplasty, penectomy or orchidectomy procedures. A large amount of evidence was available concerning vaginoplasty and clitoroplasty procedures. For FTM transsexism satisfactory outcomes were reported. Outcomes related to the ability to perform sexual intercourse, achieve orgasm and void whilst standing. Some complications were reported for both MTF and FTM procedures.

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Conclusions: The evidence concerning gender reassignment surgery in both MTF and FTM transsexism has several limitations in terms of: (a) lack of controlled studies, (b) evidence has not collected data prospectively, (c) high loss to follow up and (d) lack of validated assessment measures. Some satisfactory outcomes were reported, but the magnitude of benefit and harm for individual surgical procedures cannot be estimated accurately using the current available evidence.

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A male or female with gender identity disorder (GID) suffers from a constant feeling of psychological discomfort related to their anatomical sex and has a desire to live and be accepted as a member of the opposite sex. One method that attempts to resolve this discomfort and assist with anticipated sense of completeness is gender reassignment surgery (GRS). Through GRS a person's external sexual characteristics are altered to resemble those of the opposite sex. In this review we aim to systematically evaluate the literature concerned with the core surgical procedures for male-to-female (MTF) and female-to-male (FTM) transsexism.

Traditionally, the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)¹ has used the term 'transsexualism' and states that for a person to be diagnosed with GID they must show strong persistent cross-gender identification (not merely a desire for any perceived cultural advantages of being the other sex). In adolescents and adults, the disturbance is manifested by symptoms such as: a frequent passing as the other sex; stated desire to be the other sex and to live or be treated as the other sex; the conviction that he or she has the typical feelings and reactions of the other sex. Furthermore, disturbance can be manifested by a preoccupation with removing primary and secondary sex characteristics (e.g. request for hormones, surgery, or other procedures to physically alter sexual characteristics to simulate the other sex) or belief that they were born the 'wrong' sex. In the present review the authors have chosen to use the term 'transsexism', in recognizing that GID has no direct association to sexuality, but is directly linked with sexual identity.

Transsexism and GRS

The process by which a person comes to receive GRS is complex and occurs over a series of stages. The Harry Benjamin International Gender Dysphoria Association (HBIGDA)² has provided a set of standards that have been widely adopted by service providers. In the UK, transsexuals typically receive a diagnosis of GID by a psychologist (e.g. mental health professional, clinical psychologist) or psychiatrist. A medical consultant may then prescribe the patient with hormones. In general, persons with transsexism are required to live and work, full time, in the new gender role for 2 years to obtain real-life experience. After successful completion of this stage, a second professional confirms the diagnosis and only then can they be referred for genital surgery. It is important to recognize that this pathway is not universal.

Prevalence

The DSM-IV¹ states that, 'Data from smaller countries in Europe with access to total population statistics and referral suggest that roughly 1:30 000 adult males and 1:100 000 adult females seek sex-reassignment surgery.' Other reports present different numbers of prevalence. Only a small amount of routine data is available in the UK that may be used to estimate the prevalence of transsexism.³ The Scottish Needs Assessment Programme⁴ estimated the prevalence of transsexism in Scotland, through sending questionnaires to relevant professional groups in Scotland and to transsexual self help groups. The study found that 300 patients with transsexism were receiving treatment in Scotland and the prevalence was 8:100 000. MTF patients outnumbered FTM patients by about 4:1. The reported prevalence of transsexism has been found to vary throughout the world. Van Kesteren⁵ found the prevalence of transsexism in The Netherlands to be 1:11 900 (MTF) and 1:30 400 (FTM). Tsoi⁶ found prevalence levels of 1:2900 for MTF and 1:8300 FTM patients in Singapore. A Swedish study suggested that the number of individuals requesting GRS is 0.17 per 100 000.⁷

The aim of the review was to retrieve all available literature published since 1980 concerned with:

- The surgical treatment for persons undergoing GRS.
- Individual surgical treatment for male-to-female (MTF) and female-to-male transsexism (FTM).

We limited the search to 'core' surgical procedures, as outlined in an unpublished report by Whittaker et al.⁸ We included procedures routinely commissioned as part of a programme of treatment for patients with gender dysphoria (see Figure 1). We recognize that other core surgical procedures are available (e.g. prepuce construction), but these were outside of the scope of this review. We aimed to provide all levels of evidence available, based on the hierarchy presented by NHS Centre for Reviews and Dissemination Group recommendations.⁹

Literature searches

Sources searched

Searches were undertaken in six electronic databases (Applied Social Sciences Index and Abstracts [ASSIA], Cochrane Library [Wiley Online], Embase [Ovid Online], Medline [Ovid Online], Medline in Process [Ovid Online], Psycinfo) providing coverage of the biomedical, grey literature and current research. The publication lists, current

Core surgical procedures identified for MTF transsexism:

- Clitoroplasty
- Labiaplasty
- Orchidectomy
- Penectomy
- Vaginoplasty

Core surgical procedures identified for FTM transsexism:

- Hysterectomy
- Mastectomy
- Metoidioplasty
- Phalloplasty
- Salpingo-oophorectomy
- Scrotoplasty/placement of testicular prostheses
- Urethroplasty
- Vaginectomy

Non-core surgical procedures identified for MTF and/or FTM transsexism:

- Blepharoplasty/face-lift
- Breast augmentation in trans women
- Hair removal/provision of wigs or hair pieces
- Lipoplasty
- Thyroid chondroplasty/rhinoplasty/other facial bone reduction

Core non-surgical interventions identified for MTF and/or FTM transsexism:

- Diagnostic assessment
- Hormone therapy
- Pre- and postoperative support from a District Nurse with a specialist knowledge of sex reassignment
- Psychotherapy during all stages of active progression, including Real Life Experience
- Support and advice on style
- Voice skills therapy

Note: The list of core and non-core procedures is not exhaustive.

Figure 1 Core and non-Core procedures: surgical and non-surgical

research registers, and health services research related organizations were consulted via the world wide web (www). Keyword searching of the www was undertaken using the Google search engine. In addition, reference lists were searched for cross-references, and abstracts from conference proceedings and meetings were checked.

Keyword strategies

Sensitive keyword strategies using free-text and, where available, thesaurus terms were developed to search the electronic databases. All the core surgical procedures listed

in [Figure 1](#) were searched using keywords. In addition, a comprehensive list of terms related to GRS were used: male-to-female, mtf, female-to-male, ftm, sex-changed, sex-changing, sex-change, sex chang*, sexual reassignment, sex reassignment, sex-reassignment, gender reassignment, gender-reassignment, reassignments, reassignment surger*, trans-sexual*, trans-sexual, trans-sexualism, trans-sexually, trans-sexuals, trans sex, transsexual*, transexual*, transvestitism, transvetism, transvetite, transvetitism, transvestitismus, transvestism, transvestite*, gender dysphoria, gender-dysphoria, gender dysphoric, gender-dysphoric, gender-dysphorics, gender identity disorder, gender-identity-disorder, gender-identity-disordered, gid, gid-n, gid-us, gender transformation, gender-transformed, gender-variant, transgender, transgender-identified, transgender-specific, transgendered, transgendered-were, transgenderedness, transgendering, transgenderism, transgenderist, transgenderists, transgenderness, trans-gender*, cross dresser, cross-dresser, cross-dressers, cross sex, cross-sex, intersexuality, gender transition, transition. All search terms were searched in upper and lower case.

Search restrictions

Searches were restricted to English language literature. All searches were undertaken to retrieve literature from 1980 onwards. These searches can be extended to previous years using our search strategy, or expanded to include other techniques (e.g. hand searching of journals) and although every attempt had been made to cite all relevant literature it is possible that omissions were made. All searches were undertaken between October and November 2005.

Inclusion and exclusion criteria

One reviewer independently screened all titles and abstracts. Full paper manuscripts considered relevant by the reviewer were obtained. The relevance of each study was assessed according to the criteria set out below. Any uncertainty was discussed with a second reviewer and resolved by discussion. We included all publications that reported an individual core surgical procedure (see [Figure 1](#)) for transgender males and females and discussed the outcomes of the procedure. We did not restrict our inclusion to specific outcome measures. Unlike previous reviews (e.g. Pfäfflin and Junge)¹⁰ we did not restrict inclusion based on the number of participants, therefore, a wealth of single case studies were extracted.

Studies were excluded if they involved: expert opinion and review articles; multiple surgical procedures; non-transsexism/gender dysphoric populations; non-core surgical procedures ([Figure 1](#)); non-humans (e.g. animals); patients aged below 18 years; or publication before 1980.

Data extraction strategy

Data relating to both study design and quality were extracted by one reviewer into a standardized data extraction form and independently checked for accuracy by a second. Any discrepancies were resolved through consensus. Where multiple publications of the same study were identified, data were extracted and reported as a single study.

Quality assessment strategy

The level of evidence was assessed, based on NHS Centre for Reviews and Dissemination Group recommendations.⁹ Individual studies were assessed by one reviewer and independently checked for agreement by a second. Disagreements were resolved through consensus. Included studies were assessed for level of evidence and methodological details without any bias towards the results of the study, and there was no blinding of authorship.

Results

A total of 1170 references were screened which identified 117 published papers concerned with core surgical procedures.

Core surgical procedures for MTF transsexism

This section discusses each of the core surgical procedures outlined above for MTF transsexism. A total of 38 published papers were included (Table 1) and a further 13 papers were excluded (Table 2).

Clitoroplasty/neoclitoris construction

Three studies met the inclusion criteria^{11–13} and three additional papers were excluded.^{14–16} A range of surgical procedures were reported concerning clitoroplasty/neoclitoris construction. For example, Giraldo et al.¹² evaluated the anatomic differences among four distal designs of the pedicled island neurovascular flap of the glans penis: dorsal, lateral, ventral and corona glans clitoroplasty in MTF patients.

Table 1 Included studies concerned with MTF surgical procedures

Study	Design	N	Surgical procedure	Level of evidence
Fang et al. (1992) ¹¹	Case series	9	Clitoroplasty	III
Giraldo et al. (2004) ¹²	Case series	16	Clitoroplasty	III
Rehman and Melman (1999) ¹³	Case series	10	Clitoroplasty	III
Harder et al. (2002) ²¹	Case study	1	Neovagina construction	IV
Liguori et al. (2001) ²²	Case study	1	Neovagina construction	IV
Siemssen and Matzen (1997) ²³	Case series	11	Neovaginal construction	III
Blanchard et al. (1983) ⁵¹	Case series	55	Vaginoplasty	III
Blanchard et al. (1987) ⁵²	Case series	22	Vaginoplasty	III
Bodsworth et al. (1994) ²⁴	Case study	1	Vaginoplasty	IV
Bouman (1988) ¹³¹	Case study	55	Vaginoplasty	IV
Cova et al. (2003) ²⁵	Case series	10	Vaginoplasty	III
Eldh (1993) ²⁶	Case series	20	Vaginoplasty	III
Freundt et al. (1993) ²⁷	Case series	19	Vaginoplasty	III
Freundt et al. (1994) ²⁸	Case study	1	Vaginoplasty	IV
Fugate et al. (2000) ²⁹	Case study	1	Vaginoplasty	IV
Hage and Karim (1998) ³⁰	Case studies	6	Vaginoplasty	IV
Hage et al. (1998) ³¹	Case studies	2	Vaginoplasty	IV
Hage et al. (2000) ³²	Case series	390	Vaginoplasty	III
Hoebeke et al. (2005) ³³	Case series	31	Vaginoplasty	III
Jarrar et al. (1996) ³⁴	Case series	37	Vaginoplasty	III
Karim et al. (1995) ³⁵	Case series	200	Vaginoplasty	III
Karim et al. (1996) ³⁶	Case studies	7	Vaginoplasty	IV
Krege et al. (2001) ¹⁶	Case series	66	Vaginoplasty	III
Kwun et al. (2003) ³⁷	Case series	28	Vaginoplasty	III
Lemberger and Bishop (2001) ³⁸	Case studies	4	Vaginoplasty	IV
Liguori et al. (2004) ³⁹	Case study	1	Vaginoplasty	IV
Liguori et al. (2005) ⁴⁰	Case studies	5	Vaginoplasty	IV
Loverro et al. (2002) ⁴¹	Case study	1	Vaginoplasty	IV
Maral et al. (2002) ⁴²	Case studies	4	Vaginoplasty	IV
Perovic (1993) ⁴³	Case series	25	Vaginoplasty	III
Perovic et al. (2000) ⁴⁴	Case series	89	Vaginoplasty	III
Small (1987) ⁵³	Case series	11	Vaginoplasty	III
Stein et al. (1990) ⁴⁵	Case series	14	Vaginoplasty	III
Toolenaar et al. (1993) ⁴⁶	Case series	13	Vaginoplasty	III
Trombetta et al. (2004) ⁴⁷	Case series	10	Vaginoplasty	III
Van Engeland et al. (2000) ⁴⁸	Case studies	3	Vaginoplasty	IV
Van Noort and Nicolai (1993) ⁴⁹	Case series	27	Vaginoplasty	III
Wedler et al. (2004) ⁵⁰	Case series	53	Vaginoplasty	III

Note: level of evidence is based on NHS Centre for Reviews and Dissemination Group recommendations (2001).⁹

Table 2 Excluded literature concerned with MTF surgical procedures

Study	Design	N	Surgical procedure	Level of evidence	Reason for exclusion
Maas et al. (1999) ⁵⁴	Expert opinion	1	Colpopoiesis and vaginoplasty	V	Expert opinion
Karim (1996) ⁵⁵	Review	NA	Neovagina construction	NA	Review
Mate-Kole et al. (1990) ¹⁸	Prospective non-randomised controlled study	40	Neovagina construction, orchidectomy and penectomy	II	Multiple surgical procedures
Hage et al. (2001) ¹⁹	Case studies	4	Orchidectomy	IV	Procedure combined with vaginoplasty
Hirsch et al. (1993) ²⁰	Case series	6	Penectomy	III	No reported outcomes of penectomy procedure
Rubin (1993) ¹⁷	Case series	13	Pseudoclitoris construction and orchietomy	III	Multiple surgical procedures
Frederick and Leach (2004) ¹³²	Case studies	2	Sacral colpopexy	IV	Corrective surgical procedure
Alberta Heritage Foundation for Medical Research (1997) ⁵⁶	Review	NA	Vaginoplasty	NA	Review
Cairns and deVilliers (1980) ¹³³	Review	NA	Vaginoplasty	NA	Review
Hage et al. (1994) ¹⁴	Review	NA	Vaginoplasty and clitoroplasty	NA	Review of multiple surgical procedures
Krege et al. (2001) ¹⁶	Case series	66	Vaginoplasty and clitoroplasty	III	Multiple surgical procedures
Hage and Karim (1996) ¹⁵	Case series	60	Vaginoplasty and neoclitoroplasty	III	Multiple surgical procedures
Hage et al. (1996) ⁵⁷	Case studies	7	Vaginoplasty and vulvoplasty	IV	Multiple surgical procedures

NA = Not applicable. Note: level of evidence is based on NHS Centre for Reviews and Dissemination Group recommendations (2001).⁹

Another reported procedure involved the neoclitoris being sculptured during the actual one-stage vaginoplasty,¹⁴ although, clitoris sculpturing can also be completed in subsequent procedures in patients where the glans has not been used for this purpose. All three included papers reported successful results in terms of function and cosmetic appearance with few or no complications (e.g. urine leakage). Rehman and Melman¹³ reported that the neoclitoris had remained intact postoperatively in eight out of 10 patients and the functional and cosmetic appearance was comparable to a normal clitoris. In two patients, however, the results were not satisfactory because of necrosis of the neoclitoris.

Using the dorsal portion of the glans penis with the dorsal neurovascular pedicle for clitoroplasty, the neoclitorides in nine patients survived well, and six patients reported sexual satisfaction.¹¹ However, the transpositioning of glans on the long dorsal neurovascular pedicle appears to be a procedure with high risks.¹⁴ Overall, several studies have reported that the neoclitoris construction can result in good preservation of light touch and sexual sensation.^{11–13,15,17}

Labiaplasty

This procedure involves the creation or reshaping of the labia. No relevant literature was found concerning labiaplasty surgery in MTF transsexism.

Orchidectomy

No study met the inclusion criteria and three papers were excluded.^{17–19} This procedure is also called gonadectomy, commonly known as castration. A bilateral orchidectomy involves the removal of both testicles. Hage et al.¹⁹ concluded that, although there are many reasons for castration, they advise that bilateral orchidectomy be performed in the course of GRS for MTF transsexism.

Penectomy

No study met the inclusion criteria and two papers were excluded.^{18,20} Penectomy is the complete removal of the penis.

Vaginoplasty/neovagina construction

Thirty-two studies^{16,21–53} met the inclusion criteria and a further eight papers were excluded.^{14–16,18,54–57} Vaginoplasty involves the creation or reshaping of the vagina, this is frequently referred to as neovagina construction. A common vaginoplasty technique performed on MTF transsexuals uses tissue from the existing genitalia to create the vagina; this is often referred to as the penile inversion

technique. In some patients a lack of tissue may require additional skin grafts to be taken from the buttocks/hip area. Other patients may have a two-stage procedure that requires labiaplasty surgery to be undertaken on a separate occasion. Alternatively, a more complicated technique uses a segment of the colon (colovaginoplasty).

Satisfactory cosmetic and functional results have been reported in a large number of studies concerned with vaginoplasty/neovagina construction.^{15,16,27,32,34,40,41,44,51} One study reported that vaginoplasty combining inversion of the penile and scrotal skin flaps produced poor functional outcomes.⁵⁰ Krege et al.¹⁶ also reported that major complications during, immediately and after surgery occurred in nine of the 66 patients (14%), including necrosis of the distal urethra ($n = 1$), necrosis of the glans ($n = 3$), a rectal lesion ($n = 3$), and severe wound infections ($n = 6$). However, in using a long-term follow-up questionnaire, Krege et al. found more than 90% of their patients were satisfied with the cosmetic result and capacity for orgasm, and 58% reported having sexual intercourse.

Core surgical procedures for FTM transsexism

This section discusses each of the core surgical procedures outlined above for FTM transsexism. A total of 44 published papers were included (Table 3) and a further 19 papers were excluded (Table 4).

Hysterectomy

One study met the inclusion criteria⁵⁸ and five additional papers were excluded.^{59–63} This procedure involves the surgical removal of the uterus. A total hysterectomy is the removal of the entire uterus and the cervix. Saridogan et al.⁵⁸ reported two FTM case studies who had the hysterectomy procedure. The estimated blood loss from the operation was from less than 50 to 350 ml, the total operating time was 1.5 to 2 h and both patients made a good recovery and went home 2 days later. Saridogan et al. reported that a laparoscopic hysterectomy using the McCartney tube for FTM GRS was a useful procedure in overcoming difficulties encountered due to restricted vaginal access.

Mastectomy

Three studies met the inclusion criteria^{64–66} and two additional papers were excluded.^{61,67} The mastectomy procedure involves the surgical removal of the entire breast(s). Colic and Colic⁶⁵ found the use of a circumareolar approach for subcutaneous mastectomy produced flatter masculine breasts, leaving sufficient dermal vascularization for the nipple-areola complex. Of the 12 FTM patients all were very satisfied with the outcomes of surgery mainly because of the periareolar scar. It was reported, however, that two areolar necroses occurred due to perforation of the thin vascular dermal pedicle.

Metoidioplasty

Two studies met the inclusion criteria.^{68,69} A metoidioplasty procedure (sometimes spelt 'metaidioplasty') uses the

clitoris, overdeveloped by hormonal treatment, to construct a microphallus. Lebovic and Laub⁷⁰ first introduced this technique and named it metoidioplasty. Hage⁶⁸ found successful results of the metoidioplasty procedure in 32 FTM patients. The average stay in hospital was 11 days and only one complication in the form of a severe haematoma occurred. The procedure was considered satisfactory in 17 patients but the remaining five required additional phalloplasty, following complications of urethral stenosis in two and fistula in three patients.⁶⁹ The metoidioplasty procedure produces a very small phallus (e.g. mean = 5.7 cm, range = 4–10 cm),⁶⁹ hardly capable of sexual penetration, if at all. Only 10 of the 32 patients were able to void whilst standing.⁶⁸ It should be noted that in the study by Hage et al., 18 patients combined the metoidioplasty procedure with the construction of a bifid scrotum in which testicular prostheses were implanted. Overall these two studies found metoidioplasty was an appropriate method where the clitoris seems large enough to provide a phallus and satisfies the patient.

Phalloplasty

Thirty-six studies met the inclusion criteria^{33,71–105} and 12 additional papers were excluded.^{62,63,106–115} This technically demanding surgical procedure involves the construction of a penis in FTM transsexism. The Alberta Heritage Foundation for Medical Research¹⁰⁶ provided the only review of phalloplasty in FTM transsexism. There appear to be limited data on outcome measures, including social integration, patient satisfaction and physiological function. Good operative results have been reported in terms of appropriate size and stiffness without vascular compromise^{71,100} and in terms of psychological outcomes.⁷² In addition to an aesthetically appealing look either while being nude (81%) or wearing a tight swim suit (91%), to void whilst standing appears to be an important goal for many FTM patients.⁸⁷ It is important to recognize that there are a range of phalloplasty procedures available with mixed findings being reported in terms of effectiveness. Hage et al.⁸⁵ reported several serious complications such as vesicovaginal, urethrovaginal fistulas and urinary incontinence. Furthermore, unlike the metoidioplasty procedure, free flap phalloplasty techniques produce extensive scarring to the donor site, unless techniques such as tissue expansion are used.¹¹¹ Of the 85 FTM patients who had a phalloplasty fashioned from suprapubic abdominal wall flap that was tubed to form the phallus, Bettocchi et al.⁷³ reported the cosmetic appearance of the phallus was considered good in 68% of the patients. Major complications ($n = 60$) were associated with the neourethra (75%), stricture formation (64%) and/or fistulae (55%). It should be noted that the complication rates found by Bettocchi et al. were significantly less ($P < 0.001$) when the neourethra was created in two stages. In contrast, Khouri et al.⁹³ concluded by using a prefabricated lateral arm free flap technique it is possible to achieve a fully functional penis with stable long-term results and excellent patient satisfaction.

Salpingo-oophorectomy

Three studies reported the use of the salpingo-oophorectomy.^{60,63,116} All involved other surgical or androgen

Table 3 Included studies concerned with FTM surgical procedures

Study	Design	N	Surgical procedure	Level of evidence
Saridogan and Cutner (2004) ⁵⁸	Case study	2	Hysterectomy	IV
Burcombe et al. (2003) ⁶⁴	Case study	1	Mastectomy	IV
Colic and Colic (2000) ⁶⁵	Case series	12	Mastectomy	III
Hage and Bloem (1995) ⁶⁶	Case series	70	Mastectomy	III
Hage (1996) ⁶⁸	Case series	32	Metoidioplasty	III
Perovic and Djordjevic (2003) ⁶⁹	Case series	22	Metoidioplasty	III
Akoz and Kargi (2002) ⁷¹	Case study	1	Phalloplasty	IV
Barrett (1998) ⁷²	Cohort study	63	Phalloplasty	III
Bettocchi et al. (2005) ⁷³	Case series	85	Phalloplasty	III
Cavadas and Landin (2005) ⁷⁴	Case study	1	Phalloplasty	IV
Chesson et al. (1996) ⁷⁵	Case series	25	Phalloplasty	III
Chivers and Bailey (2000) ⁷⁶	Case series	39	Phalloplasty	III
Fang et al. (1998) ⁷⁷	Case series	20	Phalloplasty	III
Fang et al. (1999) ⁷⁸	Case series	22	Phalloplasty	III
Fisch et al. (1993) ⁷⁹	Case study	1	Phalloplasty	IV
Gilbert et al. (1987) ⁹¹	Case studies	6	Phalloplasty	IV
Hage (1997) ⁸⁰	Case study	1	Phalloplasty	IV
Hage and Bouman (1992) ⁸¹	Case series	120	Phalloplasty	III
Hage and Monstrey (1998) ⁸²	Case series	3	Phalloplasty	IV
Hage and Winters (1996) ⁸³	Case study	1	Phalloplasty	IV
Hage et al. (1993) ⁸⁴	Case series	25	Phalloplasty	III
Hage et al. (1993) ⁸⁵	Case series	46	Phalloplasty	III
Hage et al. (1993) ⁸⁶	Case series	28	Phalloplasty	III
Hage et al. (1993) ⁸⁷	Case series	79	Phalloplasty	III
Hage et al. (1993) ⁸⁸	Case study	1	Phalloplasty	IV
Hage et al. (1996) ⁸⁹	Case study	1	Phalloplasty	IV
Hoebeke et al. (2003) ⁹⁰	Case series	35	Phalloplasty	III
Hoebeke et al. (2005) ³³	Case series	24	Phalloplasty	III
Jarolim (2000) ⁹²	Case series	7	Phalloplasty	III
Khoury et al. (1998) ⁹³	Case series	3	Phalloplasty	III
Lief and Hubschman (1993) ⁹⁴	Case series	9	Phalloplasty	III
Noordanus and Hage (1993) ⁹⁵	Case study	1	Phalloplasty	IV
Papadopoulos et al. (2001) ⁹⁶	Case series	24	Phalloplasty	III
Papadopoulos et al. (2002) ⁹⁷	Case series	18	Phalloplasty	III
Rachlin (1999) ⁹⁸	Case series	27	Phalloplasty	III
Santanelli and Scuderi (2000) ⁹⁹	Case studies	5	Phalloplasty	IV
Santi et al. (1992) ¹⁰⁰	Case study	1	Phalloplasty	IV
Vesely et al. (1992) ¹⁰¹	Case study	1	Phalloplasty	IV
Vesely et al. (1999) ¹⁰²	Case series	38	Phalloplasty	III
Vesely et al. (1994) ¹⁰³	Case study	1	Phalloplasty	IV
Zielinski (1999) ¹⁰⁴	Case series	127	Phalloplasty	III
Zielinski (2001) ¹⁰⁵	Case series	209	Phalloplasty	III
Sengezer and Sadove (1993) ¹¹⁷	Case study	3	Scrotal construction	IV
Hage et al. (1999) ¹¹⁸	Case studies	4	Testicular prosthesis	IV

Note: level of evidence is based on NHS Centre for Reviews and Dissemination Group recommendations (2001).⁹

treatment and were therefore excluded. Salpingo-oophorectomy involves the surgical removal of a fallopian tube(s) and an ovary. This procedure is often completed when undertaking other surgical procedures. For example, FTM transsexism patients may request a total hysterectomy with bilateral salpingo-oophorectomy; this involves the removal of the fallopian tubes and ovaries in addition to the uterus and cervix. Futterweit and Deligdisch (1986)¹¹⁶ concluded that increased blood levels and increased ovarian concentrations of testosterone may result in the

morphological features of polycystic ovarian disease. The details of two other studies^{60,63} are provided in the hysterectomy section of this report.

Scrotoplasty/scrotum construction/testicular prosthesis

Two studies met the inclusion criteria^{117,118} and four additional papers were excluded.^{61,62,119,120} Scrotoplasty involves the creation of a scrotum. This procedure is

Table 4 Excluded literature concerned with FTM surgical procedures

Study	Design	N	Surgical procedure	Level of evidence	Reason for exclusion
Futterweit and Deligdisch (1986) ¹¹⁶	Case series	19	Bilateral salpingo-oophorectomy, pelvic surgery and androgen treatment	III	Multiple surgical procedures
Hage et al. (1993) ¹¹⁹	Expert opinion	50	Construction of a scrotum	V	Expert opinion
Chapin (1993) ⁵⁹	Expert opinion	NA	Hysterectomy	V	Expert opinion
Hage et al. (2000) ⁶⁰	Case study	2	Hysterectomy and salpingo-oophorectomy	IV	Multiple surgical procedures
Hage and van Kesteren (1995) ⁶⁷	Review	NA	Mastectomy	NA	Review
Lim (1986) ⁶¹	Case series	16	Mastectomy, hysterectomy, testicular prosthesis	III	Multiple surgical procedures
Alberta Heritage Foundation for Medical Research (1996) ¹⁰⁶	Review	NA	Phalloplasty	NA	Review
Byun et al. (1994) ¹⁰⁷	Case studies	5	Phalloplasty	IV	None transsexism population
Dabernig (2005) ¹⁰⁸	Expert opinion	NA	Phalloplasty	V	Expert opinion
Hage (1994) ¹⁰⁹	Expert opinion	NA	Phalloplasty	V	Expert opinion
Hage and Bloem (1993) ¹¹⁰	Review	NA	Phalloplasty	NA	Review
Hage and de Graaf (1993) ¹¹¹	Review	NA	Phalloplasty	NA	Review
Hage et al. (1993) ¹¹²	Review	NA	Phalloplasty	NA	Review
Hage et al. (1993) ¹¹³	Review	NA	Phalloplasty	NA	Review
Meyer et al. (1986) ⁶²	Case study	1	Phalloplasty, hysterectomy, vaginal closure, neoscrotum construction	IV	Multiple surgical procedures
Mulcahy (2003) ¹¹⁴	Review	NA	Phalloplasty	NA	Review
Rohrmann and Jakse (2003) ¹¹⁵	Case series	25	Phalloplasty, neourethra, vaginectomy, and urethroplasty	III	Multiple surgical procedures
Ozgur and Ozcan (1995) ¹²⁰	Expert opinion	NA	Scrotal construction	V	Expert opinion
Ergeneli et al. (1999) ⁶³	Case series	8	Hysterectomy, bilateral salpingo-oophorectomy, vaginectomy and phallic construction	III	Multiple surgical procedures

NA = Not applicable. Note: level of evidence is based on NHS Centre for Reviews and Dissemination group recommendations (2001).⁹

generally accomplished by hollowing out the labia majora, inserting silicone implants, and attaching the labia to develop a single scrotal sac. Implant expulsion, rupture or dislocation is encountered in a small number of patients.¹¹⁸

Urethroplasty

One study was found which reports the use of this procedure in FTM transsexism¹¹⁵ but this did not meet the inclusion criteria. Urethroplasty involves an operation to repair a defect in the walls of the urethra. A one-stage total phalloplasty and urethroplasty was associated with a significant rate of fistulas and strictures.¹¹⁵

Vaginectomy/vaginal closure

Three studies reported this procedure in FTM transsexism^{62,63,115} but they did not meet the inclusion criteria. Vaginectomy involves the surgical removal of all or part of the vagina.

Discussion

In the first section concerning MTF surgical procedures, 38 published papers met the inclusion criteria (23 case series and 15 case studies) with an additional 13 papers excluded (four case series, three case studies, four reviews, one prospective non-randomized controlled study, one expert

opinion). The level of included evidence was of poor quality.⁹ There was a clear lack of randomized controlled evidence and only one excluded study included a control group comparison. No studies met the inclusion criteria for labiaplasty, orchidectomy or penectomy procedures. A large amount of evidence is available reporting vaginoplasty and clitoroplasty procedures. Some complications have been reported. All the studies report, to various degrees, satisfactory outcomes in terms of being able to have penetrative sexual intercourse and achieving sexual fulfilment.

In the second section concerning FTM surgical procedures, 44 published papers met the inclusion criteria (26 case series, 17 case studies, one cohort study) with an additional 19 papers being excluded (seven reviews, five expert opinions, four case series, three case studies). The majority of included evidence was of poor quality.⁹ Many of the studies reported good satisfactory outcomes with few complications for each of the individual procedures. The main outcomes reported were the ability to perform penetrative sexual intercourse and achieve orgasm. Another key factor requested by many FTM patients was the ability to void whilst standing. Whilst successful results were reported by many studies for phalloplasty procedures, an inability to perform sexual penetration due to the construction of a small phallus was a common problem reported following the metoidioplasty procedure. Some of the FTM core surgical procedures are frequently completed along with other surgery, making it difficult to assess the effectiveness of each procedure alone. Furthermore, the assessment of effectiveness is also confounded by the lack of controlled evidence, unclear outcome measures, and a reliance on case series and case studies.

Six previous reviews have reported the clinical effectiveness of GRS. Six reviewed evidence in MTF patients^{3,10,121–124} and three of these also reviewed evidence in FTM patients.^{10,123,124} Of these, three were systematic reviews.^{3,121,123} These earlier reviews provide a summary of approximately 172 individual studies. Two recent unpublished reports provided a brief summary of some of the reviews.^{8,125} Several key points were raised in these previous reviews. The first related to the quality of the evidence and study design. Concerns were raised about the lack of randomized controlled evidence, the majority of evidence involved case studies and case series, with few studies using group comparisons, standardized measures or the follow up of participants. A second concern related to the validity of findings. Many studies involved a combination of different surgical procedures. Thirdly, there was concern about the validity of outcome measures. Despite many reports of positive outcomes of patients, there was little consensus of how to measure effectiveness. The large range of outcomes reported across studies makes it difficult to accurately evaluate the overall outcomes of individual surgical procedures.

Several previous reviews reported a controlled study¹⁸ which compared 20 patients having immediate surgery with 20 patients awaiting surgery for penectomy, orchidectomy and the construction of a neovagina. The remaining studies reflect lower grades of evidence, and had further problems in their design such as selected patient groups, retrospective analysis and losses to follow up. Conclusions from the reviews are understandably tentative, but highlight improvements in patients across most studies, although 10–15% of patients with transsexism who undergo GRS have poor outcomes.

The quality of evidence included in this review has been poor due to the lack of concealment of allocation, completeness of follow up and blinding. As well as the fundamental limitation in study design, several other issues regarding the interpretation of the evidence are worth consideration. Firstly, all the reviews, and many of the individual studies within them, examine different types of GRS. The Mate-Kole study,¹⁸ for example, is essentially an evaluation of three surgical techniques. Clearly, trying to reach a robust conclusion about GRS as a whole is not possible when the combination of techniques varies across studies. Secondly, the patient populations within, and across studies, are heterogeneous and we have little idea about the referral, diagnosis, assessment and selection processes that precede inclusion within the studies. Consequently, Brown¹²² concludes that a lengthy differential diagnosis and a specialized approach to interviewing gender dysphoric patients are needed. Thirdly, the choice of outcome measures varies across studies, with very little use of validated health-related quality of life (QOL) measures. This complicates further our ability to draw conclusions, and also limits the commissioners' ability to identify studies that use outcomes that are relevant to their role. Finally this review has focused on a subset of surgical procedures that are used within this field. Whilst these are considered to be the most routine,⁸ it is recognized that other procedures are currently used and these too need to be critically appraised in future reviews.

No published evidence on cost-effectiveness was found. Best and Stein³ speculate that some cost offsets are possible following surgery due to the reduced need for psychiatric and hormonal treatment, but no evidence is available for this. The lack of generic QOL measures means that measures of cost-effectiveness that can be used to assess value for money relative to other healthcare interventions are not possible.

When trying to consider all of the evidence together, there is a dilemma regarding its interpretation. Reviews of heterogeneous patient groups and interventions clearly give the greatest depth of evidence, but give little in the way of specific information that is of use to purchasers. In contrast, studies of individual techniques have a more limited evidence base but allow us to focus on specific clinical questions with more consistent reporting. But these provide information on purchasing decisions that are less realistic, as some procedures are unlikely to be purchased in isolation. In between these extremes, are sets of studies that investigate various combinations of multiple procedures, but matching these studies to the activity of different providers and patients, is extremely complex.

Taking this reasoning further, some would argue that assessment of GRS in isolation is difficult to interpret, as it is the final step in a longer treatment process. This is more contentious, as many patients do not reach the point of referral for surgery and many do not wish to undergo any surgery. Also, taking this argument to its extreme would require studies of the effectiveness of treatment from initial diagnosis to the end of post-surgical follow up; such studies do not exist.

Despite these difficulties in interpretation of review evidence the conclusion about the strength of evidence regarding GRS appears clear: little robust evidence exists.

Future research

There is a need for good quality controlled trials based on clearly defined diagnosis and assessment criteria.

An important consideration for future studies is how best to evaluate the effectiveness of a surgical procedure. One possibility is assessment of patient satisfaction and regret following surgery.^{126–129} More importantly is the need for standardised measures to assess the outcome of surgery. One suitable method, which has received limited research, is the use of QOL measures in samples before and after GRS. Rakic et al.¹³⁰ investigated several aspects of QOL after GRS in 32 patients with transsexism (22 MTF, 10 FTM). Four aspects of QOL were examined: sexual activity; attitude towards the patients' own body; relationships with other people; and occupational functioning. For the majority of persons with transsexism, QOL improved after surgery in terms of these aspects. All patients (100%) were satisfied with their GRS. However, only 20 patients (62%) were satisfied with how their bodies looked. In a study by Barrett,⁷² they used the General Health Questionnaire and assessments of depression inpatient groups. More controlled studies using this type of experimental design are needed to provide a better measure of surgical effectiveness.

For many patients undergoing GRS, their desire is to look 'normal' and be capable of having a normal sexual relationship. The results presented in this review have provided little evidence on how successful individual surgical procedures are in achieving these goals. Further research is needed to investigate these specific outcome measures of satisfaction and function.

In conclusion, we have confirmed the findings from previous reviews that the evidence to support GRS has several limitations in terms of: (a) lack of controlled studies; (b) evidence has not collected data prospectively; (c) high loss to follow up; and (d) lack of validated assessment measures. We have extended these findings from previous reviews by providing a summary of the evidence available for each of the 'core' procedures for MTF and FTM transsexism. In the majority of studies a large number of persons with transsexism experience a successful outcome in terms of subjective well being, cosmesis, and sexual function. We conclude that the magnitude of benefit and harm cannot be estimated accurately using the current available evidence.

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COMMENTARY

Evaluation of surgical procedures for sex reassignment: a systematic review

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We want to congratulate Sutcliffe et al. on their systematic review on the valuation of surgical procedure for sex reassignment surgery, published in the *Journal of Plastic, Reconstructive and Aesthetic Surgery*, in January 2008.¹ They clearly and properly evaluated the literature they were able to find (review articles, surgical techniques), at the time of their investigations.

Sutcliffe et al. performed their web investigation in October and November 2005; their article was received in August 2006; and it was accepted for publication in December 2007. The purpose of their work was to provide and evaluate the most updated literature on this subject. However, we noticed the following: Sutcliffe et al. reported 133 references, from 1980 until November 2005. A few references, already present in the scientific literature in November 2005, are missing from their article.^{2,3} Moreover, since this article was received in August 2006, further techniques/follow ups were published,^{4–7} subsequent to the original Sutcliffe investigation; finally, there was an 18 month gap between original receipt and publication. More articles were published in this period.^{8–18}

All of these resulted in a 2009 systematic review, which already needs updating after its publication.

In conclusion, with this comment, we thank again Sutcliffe et al. for their work on reviewing the literature on sex reassignment surgery, and we aim to provide some further references, which should be mandatory in a 2009 evaluation of current follow ups and surgical techniques for sex reassignment surgery. This comment, together with the Sutcliffe article, can give to the JPRAS readers an updated spectrum of the current literature on sex reassignment surgery.

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